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MULTIDISCIPLINARY/REGIONAL RESOURCE SURVEYS

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MULTIDISCIPLINARY APPLICATION OF ERTS-1 DATA TO NORTH CAROLINA NATURAL RESOURCE MANAGEMENT

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ABSTRACT

ERTS-1 imagery provides planners, managers, and politicians the possibility of seeing a macroimage of a region in a dynamic mode, the interrelations of physical geography with cultural geography, and the interdependence of many environmental and natural resource elements. Rational management of natural resources in a region is facilitated by the availability of current and frequently updated information on the location, extent, and changing characteristics of these resources.

Areas requiring priority natural resource management action can be identified on the ERTS imagery; consequently, time, manpower, and cost economies can be effected. Two examples of the usefulness of ERTS-1 data in natural resource monitoring and management in North Carolina are application of the data to water resource quality problems and to forest resource management. The two examples are cited because of their interdisciplinary importance to North Carolina natural resource management and their importance as key components of the quality of life in North Carolina.

Sediment pollution of rivers, reservoirs, and estuaries can be identified along with sources of the sediment. Such information increases the efficiency of the very limited manpower available to monitor and regulate this aspect of land and water management, and regional planners and local resource managers can be alerted to the problems and directed to the development of action programs to alleviate developing environmental difficulties.

Another positive benefit of ERTS-1 imagery is identification, location, and determination of the extent of unfavorable forest harvesting practices. Of special concern are excess area or over-concentration of clear-cut units in the proximity of water resource management areas, potential recreational development units, or necessary green-space management tracts. Early action to prevent progressive deterioration of the environment because of the improper harvesting of forest resources is facilitated. The monitoring of the undesirable practices can be done at considerable cost economies over the more conventional procedures.

NATURAL RESOURCE INVENTORY AND MONITORING IN OREGON WITH ERTS IMAGERY

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ABSTRACT

Multidisciplinary interpretation of ERTS imagery of Oregon is providing a means of integrating resources information needed for land-use planning and management. A team from Forestry, Range, Soils, Geology, Electrical Engineering, and the Computer Center produces a coordinated resource inventory resulting in a synoptic, regional overview of land resources and land-use, with significant applications in regional planning. Examples from Crook County illustrate the value of this approach on both ERTS and high flight imagery.

Preliminary interpretations of particular targets by individual disciplines and specialized techniques illustrate applications in various areas of the state. Examples include: computer analysis for detecting areas of forest insect infestation, color enhancement for forest type mapping and inventory, fault mapping (to demonstrate that the Brother fault zone is an active, juvenile system), and initial monitoring of large scale irrigation developments.

RESOURCE MANAGEMENT IMPLICATIONS OF ERTS-1 DATA TO OHIO

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ABSTRACT

Initial analyses of ERTS-1 imagery have experimentally demonstrated that remote sensing from space can be used for delineating and inventorying Ohio's strip-mined areas, detecting power-plant smoke plumes, as well as periodically providing the data necessary to compile up-to-date, land-use maps for the entire state. This paper summarizes the nature and extent of these problems throughout Ohio, illustrates how ERTS data can contribute to their solution, and estimates the long-term significance of these initial findings to overall resource management interests in Ohio.

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ASSESSMENT OF SOUTHERN CALIFORNIA ENVIRONMENT FROM ERTS-1

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ABSTRACT

ERTS-1 imagery is a useful source of data for evaluation of earth resources in Southern California. The improving quality of ERTS-1 imagery, and our increasing ability to enhance the imagery has resulted in studies of a variety of phenomena in several Southern California environments. These investigations have produced several significant results of varying detail. They include the detection and identification of macro-scale tectonic and vegetational patterns, as well as detailed analyses of urban and agricultural processes. The sequential nature of ERTS-1 imagery has allowed these studies to monitor significant changes in the environment. In addition, some preliminary work has begun directed toward assessing the impacts of expanding recreation, agriculture and urbanization into the fragile desert environment. Refinement imagery should lead to a greater capability to extract detailed information for more precise evaluations and more accurate monitoring of earth resources in Southern California.

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APPLICATIONS OF REMOTE SENSING (ERTS) TO RESOURCE MANAGEMENT AND DEVELOPMENT IN SAHELIE AFRICA (REPUBLIC OF MALI)

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ABSTRACT

The primary resource management problem in Sub-Saharan Africa (the Sahel) is increasing aridity or desertification. Observations of sand streams, dune orientations, moisture and vegetation changes and other factors associated with desertification have been made. It is not yet known whether the process is caused by human activities or climatic changes or both.

A second major interest is grazing of cattle, sheep and goats which is associated with major movements of people and animals twice yearly to obtain forage - from the savannah in fall and winter, and from huge areas of marsh (the Inland Delta) in spring and summer. These movements (transhumance) pass through more settled cultivators and into regions occupied by fishermen. The changes in available forage are being observed. The location of the cultivators is also being mapped from ERTS imagery - for the first time. Field burning after rains is widely practiced and has been observed and the extent measured in ERTS imagery. In some areas of Mali, this measurement is an estimate of area to be planted to grain in the next season - an unmeasured parameter heretofore.

Hydrological analysis is being carried on in the Niger and Bani River watersheds. The size, timing and areal extent of the annual flood is of particular interest. So far, good imagery of the maximum flood stage has been obtained and assessed.

Geologic information on fault zones, sand dune formations, scarps, tectonic basins and focal points of faulting (points from which fractures appear to radiate) are all visible and heretofore mapped inaccurately or not at all. The information on possible areas in which mineralization has occurred are being mapped and noted for Malien officials carrying on their own ERTS investigations.

Rather simple techniques of color additive projections and color subtractive composites are in use, in parallel with the practices of Malien investigators.

Thus, an inventory of Malien resources is underway - the extent of the desert, including its intrusions into the savannah, mapping of soils, new and old drainage networks, feed and water for livestock, people and land use. Malien planners are not only participating, they are directing their own investigation of the relation of ERTS imagery to their resource development requirements.

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FIRST ERTS-1 RESULTS IN SOUTHEASTERN FRANCE: GEOLOGY, SEDIMENTOLOGY, POLLUTION AT SEA

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ABSTRACT

This paper summarizes the results obtained by three ERTS projects in Southeastern France (MMC 009.01, 009.02, 009.03).

Geology: A study of photographs of the lower Rhone Valley, which lies between The Alpine folded zone and the Massif Central uplift composed of Hercynian metamorphic rocks, reveals the importance of linear fractures in the tectonics of this area.

On the ERTS-1 photographs, the trends and positions of probable faults, which are in part unknown, are clearly visible as long linear features.

In the west side of the Rhone Valley are numerous linear features trending NNE-SSW and a smaller number trending N-S. On the east side, the features trend NNE-SSW and ENE-WSW.

All these linear features appear to be independent of the folds oriented E-W or N-S. They are, at least in part, wrench faults related to the Alpine system.

A comparison with geological field data is being compiled.

Sedimentology: Surveys of the sedimentation in the Gulf of Lions have shown that two main mechanisms can be seen in the central part of the Gulf: (a) a long-term (10^4 years) progradation of The Rhone Delta and (b) a correlative beach accretion which is accompanied by short-term (10^2 years) erosion phases. Up to now, these mechanisms have been explained by general climatic changes, eustatic level changes and, for the most recent phase, by onthropic phenomena such as agriculture, water control, dam building, etc. ERTS-1 photos have revealed that some fault control has also influenced the evolution of the Gulf. Indeed, on ERTS imagery the eastern part of the Camargue region shows that outline of its former levees blunted by the present overburden resulting from a slight downward movement. The western part appears sharpened and eroded. The boundary between these two zones is a very straight line, probably a fault trending N-S, detected only on ERTS photos.

Pollution at Sea: Some industries have decided to dump their waste at sea in deep water. These dumpings are not regular in time and occur at various locations. Under good weather conditions satellite monitoring is able to detect large amounts of industrial waste. An ERTS photo shows a patch of red mud 25 km long containing ferrous oxides and sulfuric acid, dumped at sea off Corsica. In the northern part of the Ebro Delta, ERTS imagery has also revealed a very extensive "anomaly" running for about 180 km along the Spanish shoreline and about 100 km off the coast. Its origin is still unknown, but is obvious that small-scale ERTS IMAGERY is well suited to detect such large phenomena. Bad weather conditions did not allow a complete coverage of the zone to be made, and the 18-day repetition was not generally obtained.

A few examples of coherent optical processing will be presented at the end of this paper.